G-238: DuVal High School's Roach MOTEL

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BACKGROUND INFORMATION

- DuVal High School, Lanham, Maryland
- Prince George's County Public Schools
- Comprehensive public high school of 1400 students
- 91% African-American, 6% Caucasian, 2% Asian, and 1% Hispanic
- Aerospace Technology theme adopted late 1980's

Background, continued

- GAS Can reservation purchased by NCS-AIAA in 1991-1992 school year
- Began as an extra-curricular activity
- Dedicated class formed in 1992-93 school year as “Independent Studies-Aviation”
- Curriculum included math, science, English, and technology education

Background, continued

- Student teams, volunteer consultants, school-based personnel
- Funding provided by NCS-AIAA, PGCPS Aerospace Technology budget, and corporate contributions
- Seven years of work from initial start to launch on STS-95 in October, 1998

PURPOSE

- to determine the effect of microgravity on the survival of the various developmental stages of *Periplaneta americana*, the American cockroach
- to determine the effects of launch vibrations on the cockroaches
- to assess effects of microgravity on surviving cockroaches' life cycles

HYPOTHESIS

- If we seal 3 adults, 3 nymphs, and 3 egg cases in separate compartments of a habitat inside a GAS can and provide sufficient life support systems for a journey into space and back lasting no more than 6 months, we expect the roaches to carry out all life functions (including reproduction!) and return alive.

PROCEDURE

- Students originally chose three experiments (tensile strength of metals, seed germination and cockroaches)
- Space and weight constraints limited options
- Cockroach experiment was chosen and other two eliminated

Procedure, continued

- Determine the amount of food, water and air necessary for the survival of the roaches
- Determine how much g-force the roaches could withstand
- Devise experiments to determine the optimum temperature range and critical extremes of temperature for the survival of the roaches.

Procedure, continued

- Technology education teacher taught class during first three years
- In 1995, Dan Caron (well-versed in engineering design) and Carolyn Harden (a former biology teacher) took over the class
- Mechanical assistance provided by John Henrici, technical aide on loan from Science Center

Procedure, continued

- Student teams: Life Science, Structural Engineering, Electrical Engineering, Thermal Engineering, and Public Affairs
- Some components built and tested at school; others build and tested at GSFC or private machine shop

Procedure, continued

- Thermal analysis determined amount of battery power for strip heaters and video camera
- Dry-run test of sealed habitat in a sealed dissection tub June-September, 1997; 6 roaches and 3 egg cases multiplied into 75 roaches!

Procedure, continued

- NASA documentation required to be scheduled on a Shuttle mission
- Lost initial manifest on STS-91 due to incomplete Phase 3 Safety Data Package
- Rescheduled for STS-88 (December, 1998)
- Rescheduled on STS-95 in early July, 1998
- Integration done at GSFC in late July, 1998

RESULTS

- Two live roaches in the habitat at de-integration of the GAS Can on December 8, 1998
- Initial ground control roaches died of dehydration; new ground control set up in October, 1998 (3 adults, 2 nymphs, and one egg case)
- All roaches survived but egg case never hatched.

Results, continued

- The students feel as though the Roach MOTEL was a success!
- The results did not come out as expected but most of our objectives were fulfilled.
- Our experiment was the first GAS can experiment to return from space with live insects.

POSITIVE EXPERIENCES

- Interaction with NASA/GSFC personnel
- Interaction with present and retired aerospace and science professionals in the community
- Students learned to work in teams

LESSONS LEARNED

- Difficulty in doing life science experiemnt in GAS can
- Staff turnover, student turnover
- Inability to continue working beyond class period
- Difficulty in defining clear job descriptions and responsibilities for school-based staff

DuVal High School wishes to express its sincere thanks to the National Capital Section of the American Institute of Aeronautics and Astronautics for providing this unique learning experience for our students!